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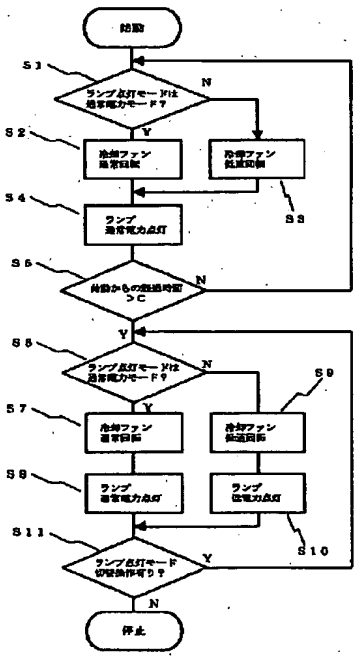
(54)【発明の名称】　画像表示装置

(57)【要約】
【課題】ランプを低電力モードで始動する場合に、ランプのバルブ温度立上り遅延により発生しやすかったちらつきを、比較的簡単に実現する方法を提供する。
【解決手段】始動、もしくは再始動からの経過時間を計測するタイマを設け、低電力モードが選択されている状態から始動、もしくは再始動の場合のみ、タイマが計測する始動からの経過時間を利用して、設定時間までは、本来ランプ点灯電力切替型安定器が低電力モードとなるところを通常電力モードとするが、ランプその他を冷却する複数の冷却ファンは、低速回転になるようにする事でランプ温度を急速に飽和させ、設定時間以降は低電力モードに戻るよう制御する事を特徴とするちらつき防止方法。

図１



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【特許請求の範囲】

【請求項１】光源用の放電ランプと、前記ランプからの光を強度変調する表示素子と、該表示素子によって強度変調された光を拡大投射する光学系とを備え、前記放電ランプに所定電力を供給する通常電力モード、および前記通常電力モードよりも低い電力を供給して前記ランプを点灯させる低電力モードのいずれかで動作するようにされた画像表示装置において、

前記低電力モードが選択されている状態からの始動の場合に、始動から所定時間経過するまでは、前記ランプに前記通常電力モードにおける所定格電力を供給するようにしたことを特徴とする画像表示装置。

【請求項２】更に前記放電ランプを冷却するための冷却ファンを備え、該冷却ファンは、前記通常電力モードの場合は第１の回転数で動作し、前記低電力モードの場合は前記第１の回転数よりも低い第２の回転数で動作することを特徴とする請求項１に記載の画像表示装置。

【請求項３】前記冷却ファンは、前記低電力モードが選択されている状態からの始動の場合に、始動から所定時間経過するまでは、前記第１の回転数で動作することを特徴とする請求項２に記載の画像表示装置。

【請求項４】光源用の放電ランプと、前記ランプからの光を表示素子の画素ごとの濃淡に替える光強度変調をおこない拡大して表示する光学系と、前記ランプの点灯モードとして、略定格電力で前記ランプを点灯させる通常電力モードおよび前記通常電力モードよりも低い電力で前記ランプを点灯させる低電力モードを有するランプ点灯電力可変型安定器と、前記ランプ点灯電力可変型安定器のランプ点灯モードを切替えるランプ点灯モード切替手段と、少なくとも前記ランプを冷却する冷却ファンと、前記冷却ファンの回転数を冷却効果の大きい第１の回転数または前記第１の回転数よりも冷却効果の小さい第２の回転数とになるように前記冷却ファンを駆動する冷却ファン駆動手段と、前記冷却ファン駆動手段に前記冷却ファンの回転数の切替えを指示するファン速度切替手段と、ランプ点灯モードを設定するランプ点灯モード切替スイッチと、前記ランプ点灯モード切替スイッチの入力により前記ランプ点灯モードとして前記通常電力モードが設定された場合前記ランプに略定格電力を供給するように前記ランプ点灯モード切替手段を制御するとともに前記ファンの回転数を前記第１の回転数となるように前記ファン速度切替手段を制御し、前記低電力モードが設定された場合前記ランプに前記低電力を供給するように前記ランプ点灯モード切替手段を制御するとともに前記ファンの回転数を前記第２の回転数となるように前記ファン速度切替手段を制御する制御手段とを備えた画像表示装置において、

始動からの経過時間を計測するタイマを設け、前記制御手段は、前記タイマの始動からの経過時間を所定の時間間隔でチェックし、低電力モードが選択されている状態

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からの始動の場合のみ、前記タイマが計測する始動からの経過時間が予め定めた所定時間となるまでは、前記ランプに略定格電力を供給するように前記ランプ点灯モード切替手段を制御し、前記ランプの温度が所定の温度となるようにしたことを特徴とする画像表示装置。

【発明の詳細な説明】

【０００１】

【発明の属する技術分野】本発明は、バックライト用放電ランプを用い、且つランプを通常電力モード、及び低電力モードの複数のランプ点灯モードを持ち、それらを自由に選択、切替可能な画像表示装置に関する。

【０００２】

【従来の技術】一般に、液晶プロジェクタ等に用いられるバックライト用高圧放電ランプはかなり高温になり、更に、ランプから出射された光束により、液晶パネル、偏光板等もかなり高温にさらされる。このため、通常、複数の冷却用ファンを用いてランプ、液晶パネル、偏光板等を冷却している。

【０００３】しかし、使用者の近くで使用される事の多い例えば前面投射型液晶プロジェクタ等においては、ファンの回転音は非常に気になる騒音と感じられ、低騒音化が求められている。又、省電力の点から低電力化も求められている。

【０００４】そのため、最近では低騒音化、或いは低電力化する為の手段として、照度を多少犠牲にしても、熱源である高圧放電ランプを低電力にて点灯させ、それに応じて、冷却用のファンの回転速度も遅くする低電力モードに切替て使用する方法が適用され始めた。以下便宜上、ランプを略定格電力（以下この電力を通常電力と称す）で駆動点灯するとともに、ファンも所定の回転速度で駆動するモードを低電力モードに対比させて通常電力モードと称することとする。

【０００５】この低電力モードでは、ランプを低電力にて駆動させる事により、ランプ自身の発熱量自体が低下し、又、それに追随してランプからの出射光が減光し、液晶パネル、偏光板等の温度をも低下するので、これらを冷却する複数の冷却用ファン全ての回転速度を、通常電力モードと比較して低速化でき、低騒音化が図れると同時に、画像表示装置として低電力化も図れる。

【０００６】以下、図４、図５を用いて従来の通常電力モードと低電力モードを備えた画像表示装置について説明する。図４は、従来技術による画像表示装置の概略構成図であり、図５は従来の電力モード切替処理を示すフローである。

【０００７】まず、図４を用いて画像表示装置の構成について説明する。図４において、スイッチ５は、これをオンする事によって画像表示装置を始動させ、オフする事によって停止させるスイッチで、このスイッチ情報はマイクロコンピュータ（以下ＣＰＵと称す）７０に入力され、ＣＰＵ７０はオン操作の場合は画像表示装置を始

動させる。ランプ点灯モード切替スイッチ６は、使用者が自由にランプ点灯モード即ち上記した通常電力モードか低電力モードかを選択して設定するスイッチである。特にスイッチでなくとも、ＯＳＤ（オンスクリーンディスプレイ）のメニュー画面等で設定できるものでもかまわない。選択されたランプ点灯モードは、ＣＰＵ７０によりＲＡＭ８に格納され、使用者がランプ点灯モード切替スイッチ６で設定を変更しない限り保持される。

【０００８】ＣＰＵ７０は、ランプ点灯モードの切替、ファン回転速度の切替等を行うとともに、画像表示装置全体を制御するものであり、内蔵する図示しないＲＯＭ（リードオンリーメモリ）に図５に示す処理プログラム等が格納されている。ランプ点灯モード切替回路１０は、ランプ点灯モード切替スイッチ６で設定されたランプ点灯モードに対応したＣＰＵ７０からの指示を受けてランプ点灯電力切替型安定器１１へ、ランプ点灯電力切替型安定器１１がランプ１５に供給する点灯電力を切替る切替信号即ち通常電力モード信号、低電力モード信号を出力する。

【０００９】ランプ点灯電力切替型安定器１１は、ランプ点灯モード切替回路１０からの切替信号により、高圧放電ランプである例えば超高圧水銀ランプのランプ１５を点灯する為の電力を通常電力もしくは低電力に切替てランプ１５を点灯駆動する。なお、この切替はランプ点灯電力切替型安定器１１が内蔵する図示しない始動装置（イグナイタともいう）でランプ１５に高電圧を印可して放電させ放電路を形成した後に行う。

【００１０】冷却ファン速度切替回路１２は、ランプ点灯モード切替スイッチ６で設定されたランプ点灯モードに対応したＣＰＵ７０からの指示を受けて、冷却ファン電圧切替型電源１３を制御する切替信号である通常回転信号、低速回転信号を出力する。冷却ファン電圧切替型電源１３は、冷却ファン速度切替回路１２から出力される切替信号により、冷却ファンへ供給する電源電圧を予め設定された所定の通常回転電源電圧もしくは低速回転電源電圧に切替る。ランプ１５、光学系１６及びランプ点灯電力切替型安定器１１を冷却する複数の冷却ファン１４（14_1、14_2、14_3）は、冷却ファン電圧切替型電源１３（13_1、13_2、13_3）からの電源電圧により、あらかじめ設定された複数の回転数のうちの１つに例えば低速回転数に制御される。

【００１１】ランプ点灯電力切替型安定器１１により電力を供給される高圧放電ランプである例えば超高圧水銀ランプのランプ１５からの光束は、表示素子である例えば偏光板１７を備えた液晶パネル１８で図示しない映像信号に対応する画素ごとの濃淡に光変調し投射レンズ（図示せず）で拡大する光学系１６により、スクリーン１９に映像光として投射される。

【００１２】次に、電力モード切替処理を示す図５のフローについて説明する。図５において、まず、始動スイッチ５をオンして画像表示装置を始動させる。始動すると、ステップ１２（以下ステップをＳと省略する）で、ＣＰＵ７０はランプ点灯モードの選択状態をＲＡＭ８から読み出し確認する。Ｓ１２において通常電力モードが選択されている場合、複数の冷却用ファン１４全ての回転速度を通常回転とし（Ｓ１３）、ランプ１５を通常電力点灯とする（Ｓ１４）。また、Ｓ１２において低電力モードが選択されている場合、複数の冷却用ファン１４全ての回転速度を低速回転とし（Ｓ１５）、ランプ１５を低電力点灯とする（Ｓ１６）。

【００１３】その後、停止されるまでの間、ランプ点灯モードの変更操作有無を監視し続ける（Ｓ１７）。Ｓ１７において、ランプ点灯モードに変更が有った場合は再びＳ１２へ戻り、上記した処理を同様に行う。Ｓ１７において、ランプ点灯モードに変更が無かった場合は、停止されるまで、それまでの状態を保持する。

【００１４】

【発明が解決しようとする課題】上記した従来技術では、低電力モードから始動する場合、下記の２つの問題があった。一つは、低電力モードでは、ランプは定格（通常）電力より低い低電力で駆動されるので、ランプのバルブ（管球）温度の立上りが遅くなり、ハロゲンサイクル不安定期間が長くなる事である。図９は従来技術におけるランプのバルブ温度の立上り特性を示す。通常電力モード時は、通常電力モードバルブ温度曲線２０に示す通り、始動後、通常電力モード飽和時間Ａで、ほぼバルブ温度が所定の最適温度に達する。しかし、低電力モード時は、低電力モードバルブ温度曲線２１に示す通り、始動後、ランプのバブル温度が飽和に達する低電力モード飽和時間Ｂまでの時間が長く、立上りが遅いので、ハロゲンサイクル不安定期間が長くなる。図６は交流ランプにおける初期のアーク形成を示すもので、図６（ａ）は対向して設けられたランプの電極を、図６（ｂ）は電極間で形成される初期のアークを示す。

【００１５】図６（ａ）において、ランプのバルブ内対向電極１間で発生するアークは、周知のように、電極１の先端の最短距離間で高温且つ尖った部分で発生しやすい。通常は、図６（ｂ）に示す通り、最短距離である電極１の中心辺りでアーク２が発生する。又、一旦アーク２が発生すると、その始点・終点部分は放出された電子が高速で衝突するので温度が高くなり、一点で安定しやすい。

【００１６】しかし、この衝突により電極が磨耗する。電極磨耗は、電極から飛び出した放出電子が、対向電極へぶつかる時に発生する。特に始動の際は、絶縁破壊させて点灯させる必要があり、高電圧を印可するので放出電子がかなり加速し、電極磨耗が大きく、磨耗範囲も広い。しかしながら、バルブ内では、周知のように、ハロゲンサイクルと言われる磨耗した電極くずの自己回復作用が有り、電極のアーク始点・終点部分の高温部分に再

生される事が知られている。又、ハロゲンサイクルを安定させるには、バルブ温度を最適温度に保つ必要がある。

【００１７】上述の通り、始動時のバルブ温度の立上りが遅いことは、電極のアーク始点・終点部分の温度が十分に高温となるまでに時間がかかり、飛散した電極くずが電極のアーク始点・終点部分に再結合するハロゲンサイクルが不十分となり、ハロゲンサイクル不安定期間が長くなる，ハロゲンサイクルが不安定になると、磨耗した電極が自己回復せず、飛散した電極くずがランプ管球に付着する黒化という現象が発生し、照度低下や短寿命化といった不具合を引き起こしやすい事が知られている。一方、ハロゲンサイクルが安定している場合は、磨耗した電極が自己回復し、不具合には至らない。

【００１８】バルブ温度については、通常電力モード時は、ランプ冷却用のファンを最適化する事で比較的容易に最適温度を達成できる。しかし、低電力モード時は、通常電力モード時と比較して、バルブ内電極間で飛び交う電子が少ないゆえ電極温度が低く、ランプ冷却用のファンの回転速度を遅くして最適化したとしても、図９で明らかなように、最適温度まで上げる事は困難である。つまり、低電力モード飽和時間Ｂ以降も通常電力モード時と比べ、ハロゲンサイクル不安定とまでは言わないまでも、安定度としては僅かながら劣る為、常に不具合が発生しやすい危険性を抱えていた。

【００１９】また、もう一つの問題点として、ちらつきが発生しやすい事が挙げられる。図７は通常電力モード時における電極成長、及びアークの飛び方を示す。始動時のバルブ温度立上りが早く、すぐにバルブ最適温度に達するので、ハロゲンサイクル不安定期間が短く、電極1の磨耗はさほど無い。ハロゲンサイクル安定後は、電極1先端のアークの始点・終点部分に、僅かながら磨耗した電極くずの自己回復作用により、鋭利な突起３が一個だけ成長する。図７で示すように、この突起３の先端は尖っており、且つ最短距離でもあり、図６（ｂ）の初期のアーク安定度に比べて、更に一点で安定な状態に移行する。

【００２０】図８は低電力モード時における始動時のアークの飛び方、電極温度が飽和するまでの期間の電極磨耗、電極温度飽和後のアークの飛び方を示す。低電力モードでは、バルブ飽和温度に達するまでの期間が長い上、電極１間を飛び交う電子も少ない為、電極の先端のアークの始点・終点部分の温度も充分に上がらない。バルブ温度が飽和するまでの期間、図８（ａ）のようにアーク２が一点で安定せず、この安定しないアーク２の始点・終点部分の電極１は図８（ｂ）のように磨耗するが、ハロゲンサイクルが不安定な為自己回復せず、不規則な複数の磨耗突起４が出来てしまう。その後、図８（ｃ）のように磨耗突起４の先端でアーク２が飛ぶようになる。バルブ温度飽和後は、ハロゲンサイクルが安定

するので、磨耗突起４の先端に磨耗した電極くずが自己回復し、更に鋭利な突起３となり、ますますどの突起３の先端間ででもアーク発生しやすい状態となる。このアーク不安定な状態は、一般的にアークジャンプと呼ばれる。投射画面上ではちらつき、或いはフリッカという不具合がでるようになる，更に、上述の通り、バルブ温度飽和後も最適温度に達していない為、通常電力モード時と比較して、アーク安定度としては劣り、アークジャンプに拍車をかける事になる。

【００２１】これらの要因により、低電力モード時の上記ちらつき発生を避ける事は困難であった。本発明の目的は、上記課題を解決し、低電力モード時のちらつき発生を防止する画像表示装置を提供することにある。

【００２２】

【課題を解決するための手段】上記課題を解決するため、本発明は、光源用の放電ランプと、前記ランプからの光を強度変調する表示素子と、該表示素子によって強度変調された光を拡大投射する光学系とを備え、前記放電ランプに所定電力を供給する通常電力モード、および前記通常電力モードよりも低い電力を供給して前記ランプを点灯させる低電力モードのいずれかで動作するようにされた画像表示装置において、前記低電力モードが選択されている状態からの始動の場合に、始動から所定時間経過するまでは、前記ランプに前記通常電力モードにおける所定格電力を供給するようにしたことを特徴とするものである。

【００２３】このように構成することにより、始動から前記所定時間までは、低電力モードが選択されていても、略定格電力を前記ランプに供給することができるので、前記ランプのバルブ温度を急峻に立ち上げることができ、前記ランプの電極の先端に図７に示す安定な突起を形成することができる。これにともない、ハロゲンサイクルによる飛散電極くずの電極への再結合が行われ、ランプの短寿命化、および黒化低減による照度低下を防止できる効果がある。

【００２４】

【発明の実施の形態】以下、本発明の実施の形態について図１、図２と図３を用いて説明する。図２は本発明の実施の形態である画像表示装置のブロック図、図１は本発明による電力モード切替処理を示すフロー、図３は本発明によるランプ点灯電力とランプバルブ温度との関係を示す図である。

【００２５】まず、図２を用いて画像表示装置の構成について説明する。図２において、ＣＰＵ７は、ランプ点灯モードの切替、ファン回転速度の切替等を行うとともに、画像表示装置全体を制御するものであり、内蔵するＲＯＭ（図示せず）に図１に示す処理プログラム等が格納されている。タイマ９は、始動スイッチ５がオンされ、ＣＰＵ７が制御を開始した時点から経過時間カウントを開始するようＣＰＵ７によって制御され、タイマ９

でカウントされた経過時間は所定の時間間隔でＣＰＵ７に送信される。図２において、図４に同一な部分には同一な符号を付して、その説明を省略する。なお、図２において、ＣＰＵ７は冷却ファン速度切替回路１２で冷却ファン電圧切替型電源１３の冷却ファン１４への出力電源電圧を切替、また、ランプ点灯モード切替回路１０でランプ点灯電力切替型安定器１１のモードを切替ているが、ＣＰＵ７が直接冷却ファン電圧切替型電源１３とランプ点灯電力切替型安定器１１を制御できるならば、冷却ファン速度切替回路１２とランプ点灯モード切替回路１０は必要ないことは当然である。

【００２６】次に、図３について説明する。図３（ａ）はランプに印可される点灯電力を示し、図３（ｂ）はランプのバルブ温度を示す。図３（ａ）から明らかなように、従来、通常電力モードでは通常電力モード点灯電力曲線２２で示す通常電力をまた低電力モードでは低電力モード点灯電力曲線２３で示す低電力をランプに供給していたが、本発明では、低電力モード時、低電力モード点灯電力曲線２４で示すように、始動から予め設定した所定の設定時間Ｃまでは通常電力を供給し、設定時間Ｃを過ぎると低電力を供給するようにする。これにより、図３（ｂ）のように、低電力モード時低電力モード点灯電力曲線２４に対応するランプのバルブ温度は、低電力モードバルブ温度曲線２５の通りとなり、設定温度Ｃで最適温度に達し、その後だらだらと温度低下し低電力モード飽和時間Ｂで低電力モード点灯時最大温度に達し飽和する。なお、図３（ｂ）で２０は通常電力モードバルブ温度曲線、２１は従来の低電力モードバルブ温度曲線である。

【００２７】本発明は、ランプを通常電力モードにて始動する場合は図５の処理フローと同じであるが、ランプを低電力モードにて始動する際のちらつき防止処理を、図１の本発明による電力モード切替処理を示すフローに沿って説明する。

【００２８】スイッチ５がオンされて画像表示装置が始動されると、ＣＰＵ７はＳ１でＲＡＭ８に格納されたランプ点灯モードの選択状態を取込み、ランプ点灯モードの選択状態を確認する。

【００２９】ここで、Ｓ１において通常電力モードが選択されていた場合、ＣＰＵ７より通常回転指示が冷却ファン速度切替回路１２に出され、冷却ファン速度切替回路１２から通常回転信号が冷却ファン電圧切替型電源１３へ出力され、冷却ファン電圧切替型電源１３は通常回転時の電源電圧を冷却ファン１４へ供給し、全ての冷却ファン１４の回転速度を通常回転とする（Ｓ２）。

【００３０】また、Ｓ１において低電力モードが選択されている場合、Ｓ３でＣＰＵ７より低速回転指示が冷却ファン速度切替回路１２に出され、冷却ファン速度切替回路１２から低速回転信号が冷却ファン電圧切替型電源１３へ出力され、冷却ファン電圧切替型電源１３は低速回転時の電源電圧を冷却ファン１４へ供給し、全ての冷却ファン１４の回転速度を低速回転とする。

【００３１】次に、Ｓ４で、Ｓ１でのランプ点灯モードの選択状態に係わらず、ＣＰＵ７より通常電力点灯指示がランプ点灯モード切替回路１０に出され、ランプ点灯モード切替回路１０からランプ点灯電力切替型安定器１１へ通常電力モード信号が出力され、ランプ点灯電力切替型安定器１１はランプ１５へ通常電力を供給し、ランプ１５は通常電力点灯となる。このように、Ｓ１でのランプ点灯モードの選択状態にかかわらず、図３（ａ）の本発明の低電力モード点灯電力曲線２４のように、始動から設定時間Ｃまでの期間、通常電力点灯とする。この点が従来方式との大きな違いである。尚、設定時間Ｃは、ランプ１５のバルブ温度が最適温度に達する時間で選べばよく、低電力モード飽和時間Ｂより短くなる。

【００３２】その後、Ｓ５で、始動からの経過時間が予め設定した所定の設定時間Ｃを超えるかチェックし、超えない場合はＳ１へ戻り、上記フローを繰り返す。また、超える場合はＳ６へ行く。

【００３３】こうすることにより、図３（ｂ）の本発明の低電力モードバルブ温度曲線２５に示す通り、ランプ点灯モードが低電力モードであっても始動から設定時間Ｃの期間でバルブ温度を急速に立上らせる事が出来る。その結果、ハロゲンサイクルが加速し、図７のように各電極１の先端に突起３が一個だけ成長する。

【００３４】ファン速度を低速回転にしておく理由は、バルブ温度を急速に立上らせる事で、ハロゲンサイクルを加速させる目的に加え、低電力モードの目的が低騒音である場合のことを配慮したものである。但し、この期間の各部の冷却能力が不充分であることは避けられないので、使用部材の温度定格を超えない事を確認しておく必要がある。

【００３５】Ｓ６以降は図５に示す従来の処理フローと同じである。以下、Ｓ６で、ＣＰＵ７がランプ点灯モード切替スイッチ６の状態を監視し、ランプ点灯モードの状態を確認する。ここで、Ｓ６において通常電力モードが選択されている場合、複数の冷却用ファン１４全ての回転速度を通常回転とし（Ｓ７）、ランプ１５を通常電力点灯とする（Ｓ８）。

【００３６】また、Ｓ６において低電力モードが選択されている場合、複数の冷却用ファン１４全ての回転速度を低速回転とし（Ｓ９）、ランプ１５を低電力点灯とする（Ｓ１０）。この時バルブ温度は図３（ｂ）の本発明の低電力モードバルブ温度曲線２５に示す通り、設定時間Ｃ以降下がり始め、従来と同じく、低電力モード飽和時間Ｂで低電力駆動時の最大温度に達し飽和する。この飽和した温度は最適温度よりも少し低く、アーク安定度としては僅かに劣る状態である事は既に述べた通りである。

【００３７】しかし、本発明により始動から設定時間Ｃ

までの期間でハロゲンサイクルを加速させた結果、各電極先端に突起が一個だけ成長しているので、アーク安定度は充分である事に加え、ハロゲンサイクルで更に突起が成長してアークが非常に安定する為、アークジャンプは非常に起こりにくく、ちらつきには至らない。

【００３８】その後、停止されるまでの間、ランプ点灯モードの変更操作有無を監視し続ける（Ｓ１１）。Ｓ１１において、ランプ点灯モードに変更が有った場合は再びＳ６へ戻り、その後はＳ６からＳ１１までの上記フローを繰り返す。Ｓ１１において、ランプ点灯電力モードに変更が無かった場合は、停止するまでそれまでの状態を保持する。

【００３９】以上述べたように、低電力モード時、図３（ａ）の低電力モード点灯電力曲線２４で示すように、始動から設定時間Ｃまでは、低電力モードが選択されていても通常電力をランプに供給することにより、ハロゲンサイクル不安定期間を従来の低電力モード時に比べ短くすることができ、電極先端に一個の安定な突起を形成することができるので、アークジャンプに起因するちらつきを防止することが出来る他、ハロゲンサイクルによる飛散電極くずの電極への再結合にともないランプ短寿命化、及び黒化低減による照度低下等も防止できる。

【００４０】なお、上記説明では、始動から所定の設定時間Ｃまではランプを通常電力点灯とし、冷却ファン１４は設定されたランプ点灯モードにより通常回転か低速回転としたが、処理フローを簡略化するために、始動から所定の設定時間Ｃまではランプを通常電力点灯とするとともに、冷却ファン１４も低速回転とするようにしてもよい。このようにすることにより、通常電力モードでもハロゲンサイクル不安定期間を従来に比べ短くすることができる。

【００４１】

【発明の効果】低電力モードで始動する際に、ランプ駆動電力、及び冷却ＦＡＮをタイマと制御手段により制御し、ランプバルブ内温度の立上りを急峻にすることによって、ハロゲンサイクル不安定期間を極めて短くすることが可能となり、ちらつきを防止することが出来る他、ランプ短寿命化、照度低下等も防止できる。

【図面の簡単な説明】

【図１】本発明による電力モード切替処理を示すフロー。

【図２】本発明の実施の形態である画像表示装置のブロック図。

【図３】本発明によるランプ点灯電力とランプバルブ温度との関係を示す図。

【図４】従来技術による画像表示装置の概略構成図。

【図５】従来の電力モード切替処理を示すフロー。

【図６】交流ランプにおける初期のアーク形成を示す図。

【図７】通常電力モード時における電極成長、及びアークの飛び方を示す図。

【図８】低電力モード時における始動時のアークの飛び方、電極温度が飽和するまでの期間の電極磨耗、電極温度飽和後のアークの飛び方を示す図。

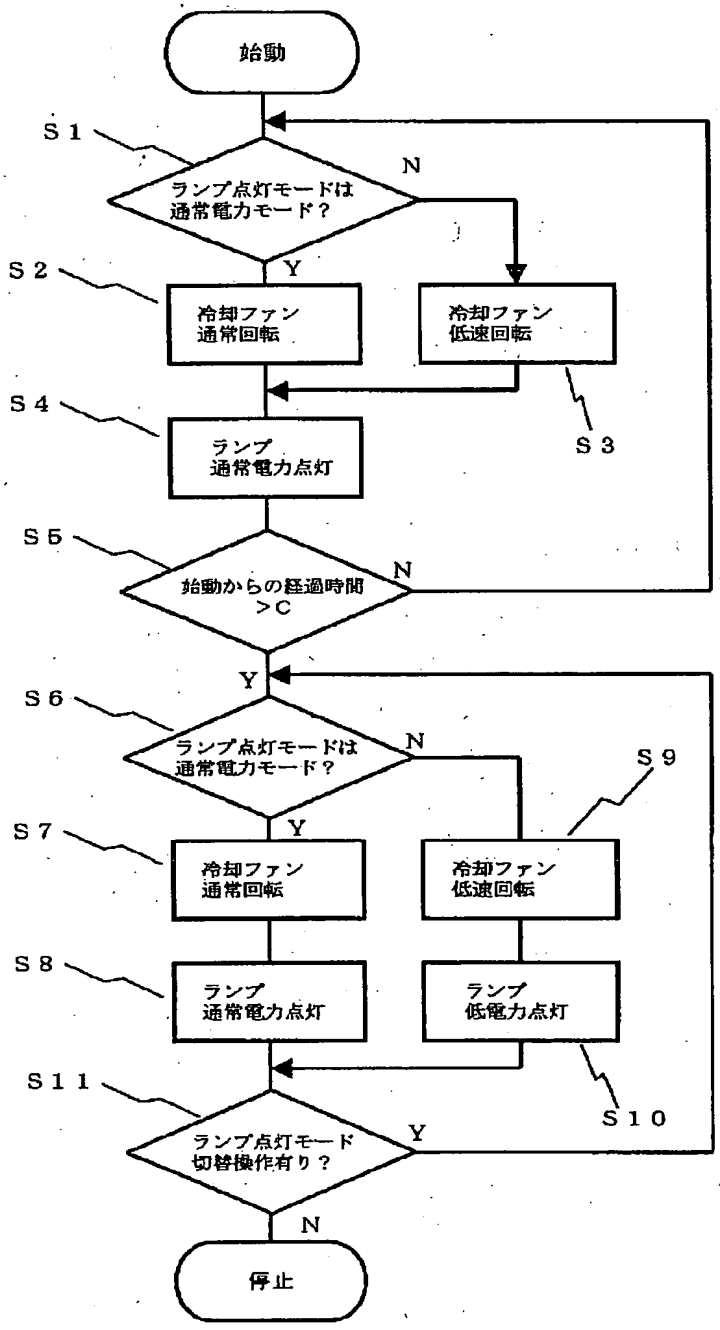
【図９】従来技術におけるランプのバルブ温度の立上り特性。

【符号の説明】

１･･･電極
２･･･アーク
３･･･ハロゲンサイクルで自己回復した突起
４･･･磨耗電極
５･･･スイッチ
６･･･ランプ点灯モード切替スイッチ
７、７０･･･ＣＰＵ
８･･･ＲＡＭ
９･･･タイマ
１０･･･ランプ点灯モード切替回路
１１･･･ランプ点灯電力切替型安定期
１２･･･冷却ファン速度切替回路
１３･･･冷却ファン電圧切替型電源
１４･･･冷却ファン
１５･･･ランプ
１６･･･光学系
１７･･･偏光板
１８･･･液晶パネル
１９･･･スクリーン
２０･･･通常電力モードバルブ温度曲線
２１･･･従来の低電力モードバルブ温度曲線
２２･･･通常電力モード点灯電力曲線
２３･･･従来の低電力モード点灯電力曲線
２４･･･本発明の低電力モード点灯電力曲線
２５･･･本発明の低電力モードバルブ温度曲線

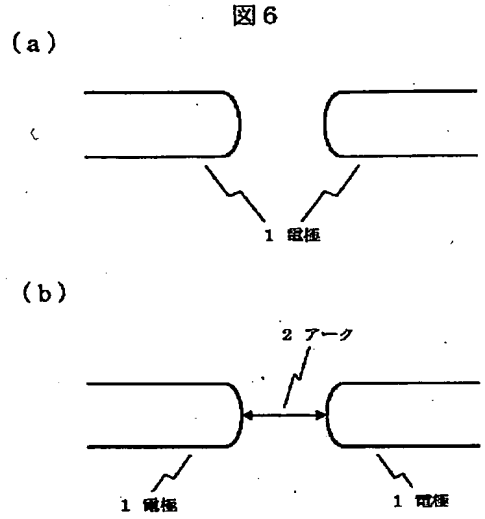
【図１】

図１



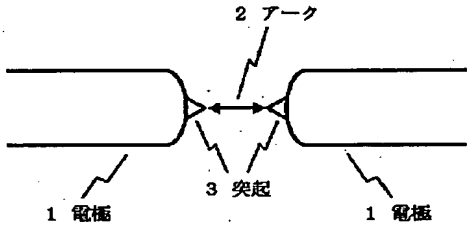
【図６】

図６



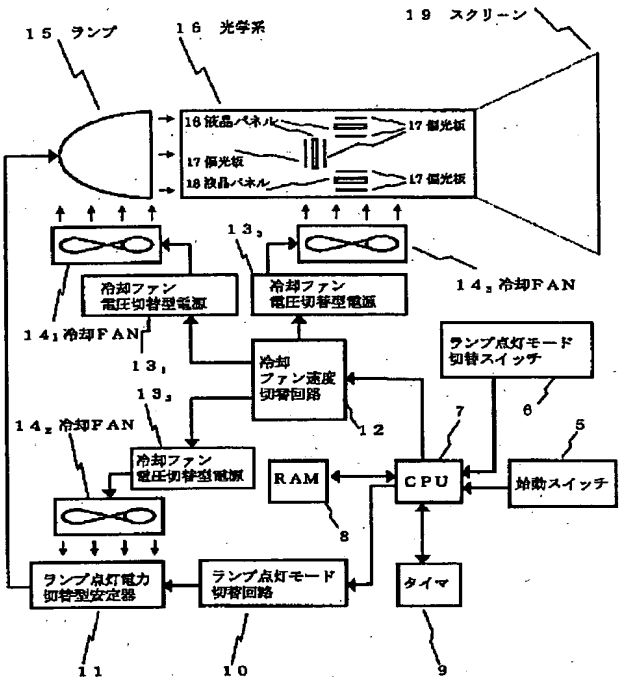
【図７】

図７



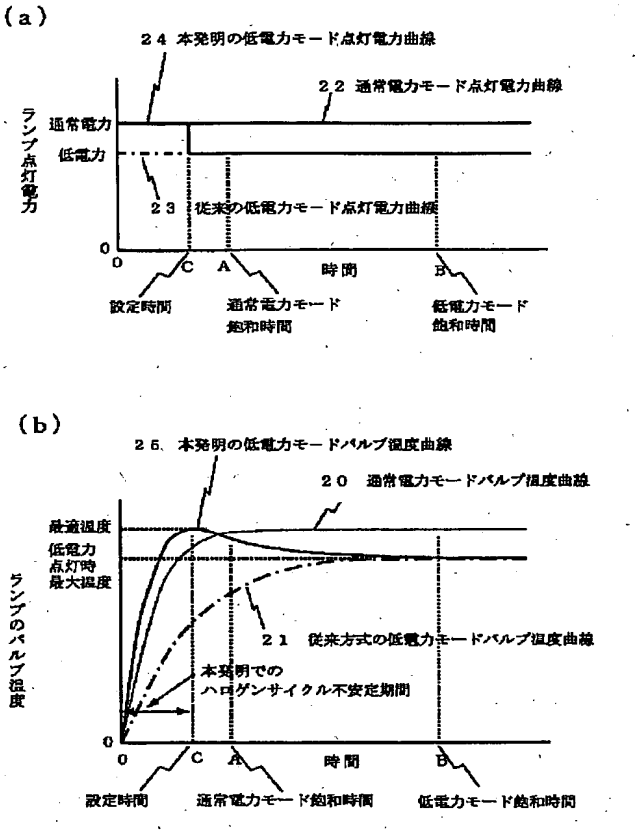
【図２】

図２



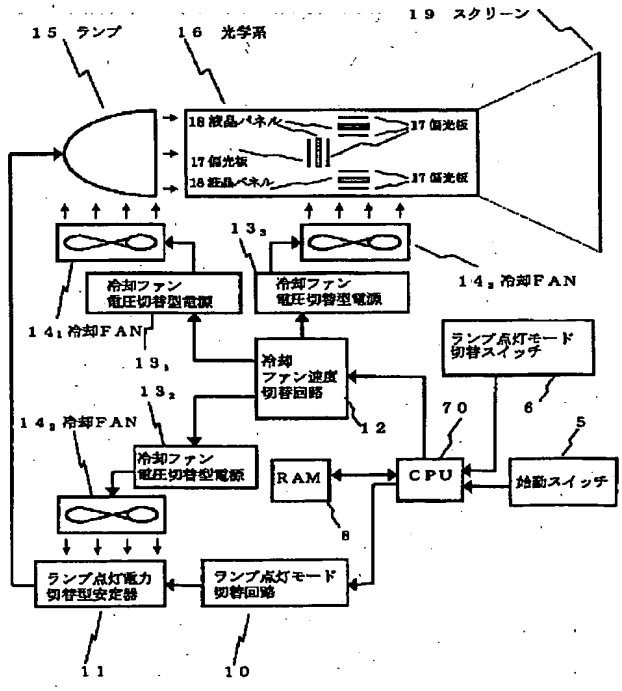
【図３】

図３



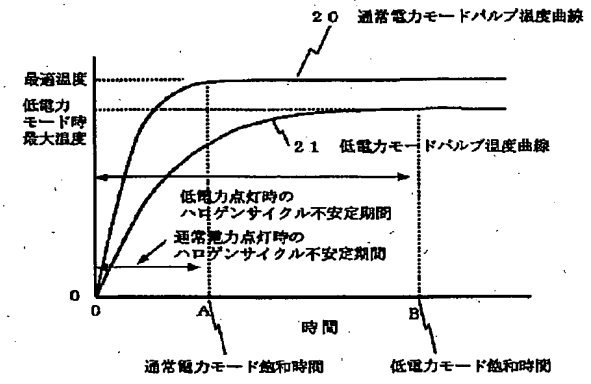
【図４】

図４



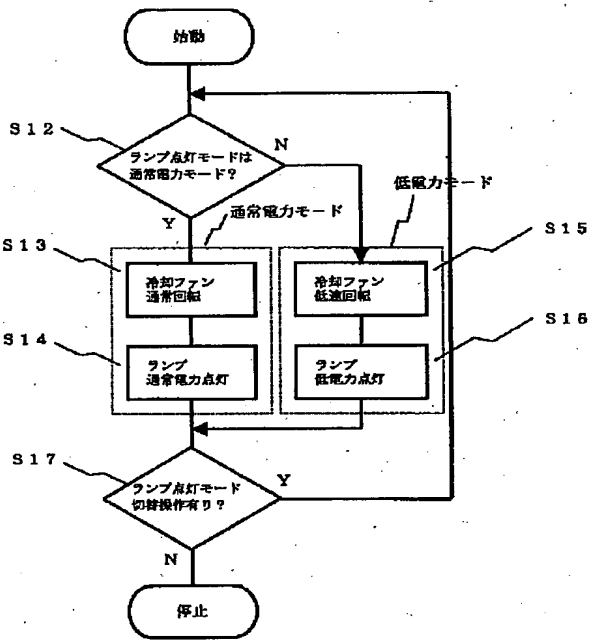
【図９】

図９



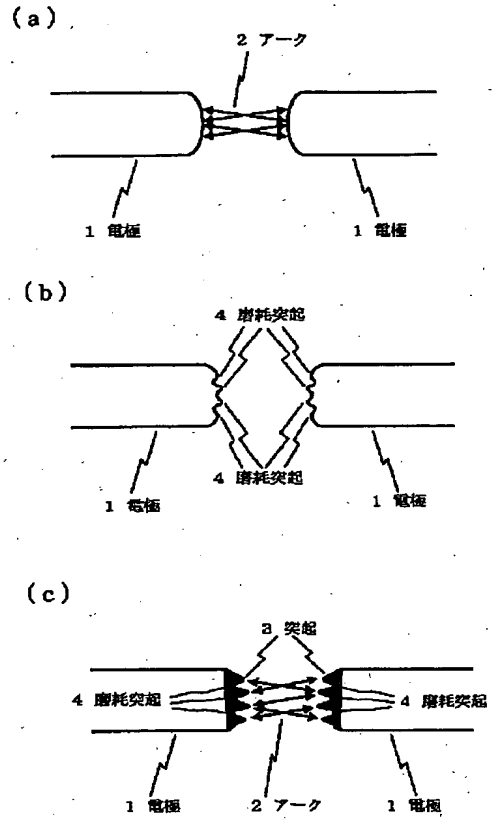
【図５】

図５



【図８】

図８



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CLAIMS

[Claim(s)]
[Claim 1] The discharge lamp for the light sources, and the display device which carries out intensity modulation of the light from said lamp, It has the optical system which carries out expansion projection of the light in which intensity modulation was carried out by this display device. In the image display device it was made to usually operate with either of the power modes and the low power modes in which supply said power usually lower than power mode, and said lamp is made to turn on which supply predetermined power to said discharge lamp The image display device characterized by supplying said predetermined rank power [in / usually / power mode] at said lamp until it carried out predetermined time progress from starting in starting from the condition that said low power mode is chosen.
[Claim 2] Furthermore, it is the image display device according to claim 1 with which it has a cooling fan for cooling said discharge lamp, and it usually operates at the 1st rotational frequency in the case of power mode, and this cooling fan is characterized by said thing [operating at the 2nd rotational frequency lower than said 1st rotational frequency in the case of said low power mode].
[Claim 3] Said cooling fan is an image display device according to claim 2 characterized by in starting from the condition that said low power mode is chosen operating at said 1st rotational frequency until it carries out predetermined time progress from starting.
[Claim 4] The discharge lamp for the light sources, and the optical system which performs, expands and displays the optical intensity modulation which changes the light from said lamp to the shade for every pixel of a display device, The lamp lighting power good transformation stabilizer which has the low power mode in which said lamp is made to turn on with abbreviation rated power and in which said lamp is made to usually turn on with power mode and said power usually lower than power mode, as lighting mode of said lamp, The lamp lighting mode change means which changes the lamp lighting mode of said lamp lighting power good transformation stabilizer, The cooling fan which cools said lamp at least, and the cooling-fan driving means which drives said cooling fan so that it may become the 2nd rotational frequency with the cooling effect smaller than the 1st large rotational frequency or said 1st rotational frequency of the cooling effect about the rotational frequency of said cooling fan, A fan speed change means to direct the change of the rotational frequency of said cooling fan to said cooling-fan driving means, The lamp lighting mode circuit changing switch which sets up lamp lighting mode, While controlling said lamp lighting mode change means to supply abbreviation rated power to said lamp as said lamp lighting mode by the input of said lamp lighting mode circuit changing switch when [said] power mode is usually set up Said fan speed change means is controlled to become said 1st rotational frequency about said fan's rotational frequency. In the image display device equipped with the control means which controls said fan speed change means to become said 2nd rotational frequency about said fan's rotational frequency while controlling said lamp lighting mode change means to supply said low power to said lamp, when said low power mode is set up The timer which measures the elapsed time from starting is formed. Said control means Only in starting from the condition that check the elapsed time from starting of said timer with a predetermined time interval, and low power mode is chosen The image display device

characterized by controlling said lamp lighting mode change means to supply abbreviation rated power to said lamp, and making it the temperature of said lamp turn into predetermined temperature until the elapsed time from starting which said timer measures turned into predetermined time defined beforehand.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] Using the discharge lamp for back lights, this invention usually has power mode and two or more lamp lighting modes in low power mode for a lamp, and relates them to the image display device which can be chosen and changed freely.
[0002]
[Description of the Prior Art] Generally, the high-pressure discharge lamp for back lights used for a liquid crystal projector etc. becomes an elevated temperature considerably, and a liquid crystal panel, a polarizing plate, etc. are further exposed considerably to an elevated temperature according to the flux of light by which outgoing radiation was carried out from the lamp. For this reason, the lamp, the liquid crystal panel, the polarizing plate, etc. are usually cooled using two or more fans for cooling.
[0003] However, for example in the front projection mold liquid crystal projector etc., a fan's rotation sound is sensed as the noise with being used [much] near the user worried very much, and low noise-ization is called for. Moreover, low electrification is also called for from the point of power saving.
[0004] Therefore, recently, as the reduction in the noise, or a means for low-electrifying, even if it made some illuminances into the sacrifice, the high-pressure discharge lamp which is a heat source is made to turn on with low power, and the approach of carrying out change ****** began to be applied to the low power mode which also makes rotational speed of the fan for cooling late according to it. Below, for convenience, while carrying out drive lighting of the lamp with abbreviation rated power (this power is usually called power below), suppose that a fan also makes the mode driven with a predetermined rotational speed contrast with low power mode, and usually calls power mode.
[0005] In this low power mode, since the own calorific value of a lamp itself falls, and it follows in footsteps of it, the outgoing radiation light from a lamp dims and the temperature of a liquid crystal panel, a polarizing plate, etc. is also fallen by making a lamp drive with low power, while-izing of the rotational speed of two or more fans for cooling of all, that cool these, can usually be carried out [low speed] as compared with power mode and low noise-ization can be attained, low electrification can also be attained as an image display device.
[0006] Hereafter, the image display device equipped with conventional usual power mode and low power mode using drawing 4 and drawing 5 is explained. Drawing 4 is the outline block diagram of the image display device by the conventional technique, and drawing 5 is a flow which shows the conventional power mode change processing.
[0007] First, the configuration of an image display device is explained using drawing 4 . In drawing 4 , when a switch 5 turns this on, it is the switch stopped by making it start and turning off an image display device, this switch information is inputted into a microcomputer (Following CPU is called) 70, and, in ON actuation, CPU70 starts an image display device. The user of the lamp lighting mode circuit changing switch 6 is in lamp lighting mode, i.e., the above-mentioned switch which usually chooses and sets up power mode or low power mode, freely. Even if it is not especially a switch, what can be set up in the menu screen of OSD (onscreen display) etc. may

be used. The selected lamp lighting mode is stored in RAM8 by CPU70, and unless a user changes a setup with the lamp lighting mode circuit changing switch 6, it is held.
[0008] While CPU70 performs the change in lamp lighting mode, the change of fan speed, etc., the whole image display device is controlled, and the processing program shown in ROM (read only memory) to build in, and which is not illustrated at drawing 5 is stored. The lamp lighting mode electronic switch 10 outputs the change signal, i.e., a usual power mode signal, which changes the lighting power which the lamp lighting power change mold stabilizer 11 supplies to a lamp 15, and a low power mode signal to the lamp lighting power change mold stabilizer 11 in response to the directions from CPU70 corresponding to the lamp lighting mode set up with the lamp lighting mode circuit changing switch 6.
[0009] The lamp lighting power change mold stabilizer 11 usually carries out the lighting drive of the ****** lamp 15 for the power for [which is a high-pressure discharge lamp] turning on the lamp 15 of an extra-high pressure mercury lamp, for example with the change signal from the lamp lighting mode electronic switch 10 at power or low power. In addition, after carrying out the seal of approval of the high voltage, and this change making it discharge on a lamp 15 with the starting system (for it to also be called an ignitor) which the lamp lighting power change mold stabilizer 11 contains and which is not illustrated and forming a discharge way, it is performed.
[0010] The cooling fan speed electronic switch 12 outputs the usual rotation signal and low-speed rotation signal which are a change signal which controls the cooling-fan electrical-potential-difference change mold power source 13 in response to the directions from CPU70 corresponding to the lamp lighting mode set up with the lamp lighting mode circuit changing switch 6. The cooling-fan electrical-potential-difference change mold power source 13 changes the supply voltage supplied to a cooling fan to the predetermined usual rotation supply voltage or the low-speed rotation supply voltage set up beforehand with the change signal outputted from the cooling fan speed electronic switch 12. Two or more cooling fans 14 (141, 142, 143) which cool a lamp 15, optical system 16, and the lamp lighting power change mold stabilizer 11 are controlled by supply voltage from the cooling-fan electrical-potential-difference change mold power source 13 (131, 132, 133) by one of two or more rotational frequencies set up beforehand at reduced rpm.
[0011] For example, the flux of light from the lamp 15 of an extra-high pressure mercury lamp is projected by the screen 19 as an image light according to the optical system 16 which carries out light modulation to the shade for every pixel corresponding to the video signal which is not illustrated with the liquid crystal panel 18 which is the high-pressure discharge lamp to which power is supplied with the lamp lighting power change mold stabilizer 11, which is a display device, and which was equipped with the polarizing plate 17, for example and which is expanded with a projector lens (not shown).
[0012] Next, the flow of drawing 5 which shows power mode change processing is explained. In drawing 5 , first, a starting switch 5 is turned on and an image display device is started. If it starts, at step 12 (a step is abbreviated to S below), CPU70 will read the selection condition in lamp lighting mode from RAM8, and will check it. the case where power mode is usually chosen in S12 — two or more fans 14 for cooling — all rotational speed is usually considered as rotation (S13), and a lamp 15 is usually considered as power lighting (S14). moreover, the case where low power mode is chosen in S12 — two or more fans 14 for cooling — all rotational speed is considered as low-speed rotation (S15), and a lamp 15 is considered as low power lighting (S16).
[0013] Then, supervising the modification actuation existence in lamp lighting mode is continued until it is stopped (S17). In S17, when lamp lighting mode has modification, return and the above-mentioned processing are again performed similarly to S12. In S17, when there is no modification in lamp lighting mode, the condition till then is held until it is stopped.
[0014]
[Problem(s) to be Solved by the Invention] With the above-mentioned conventional technique, when starting from low power mode, there were the two following problems. Since one drives a lamp with low power lower than rated (usually) power in low power mode, it is that the standup of the bulb (bulb) temperature of a lamp becomes late, and a halogen cycle unstable period becomes long. Drawing 9 shows the rising characteristic of the bulb temperature of the lamp in

the conventional technique. Usually, at the time of power mode, after starting, it is usually the power mode saturation time A, and bulb temperature reaches a predetermined optimum temperature mostly as usually shown in the power mode bulb temperature curve 20. However, since the time amount to the low power mode saturation time B to which the bubble temperature of a lamp reaches saturation is long after starting and the standup is late, a halogen cycle unstable period becomes long as shown in the low power mode bulb temperature curve 21 at the time of low power mode. Drawing 6 shows the early arc formation in an alternating current lamp, and drawing 6 (a) shows the early arc in which drawing 6 (b) is formed by inter-electrode in the electrode of the lamp countered and formed.

[0015] In drawing 6 (a), it is easy to generate the arc generated between the counterelectrodes 1 in a bulb of a lamp in an elevated temperature and the sharp part between the minimum distances at the tip of an electrode 1 as everyone knows. Usually, an arc 2 occurs in the central neighborhood of the electrode 1 which is the minimum distance as shown in drawing 6 (b). Moreover, once an arc 2 occurs, since the emitted electron collides at high speed, temperature will become high, and its starting point and terminal point part will tend to be stabilized in one point.

[0016] However, an electrode is worn out by this collision. The emission electron which jumped out of the electrode generates electrode wear, when colliding to a counterelectrode. It is necessary to carry out dielectric breakdown and to make the light switch on, since the seal of approval of the high voltage is carried out, the emission electron accelerates considerably, especially in the case of starting, electrode wear is large, and its wear range is also wide. However, within the bulb, the self-healing of the worn-out electrode waste called halogen cycle occurs as everyone knows, and it is known that the elevated-temperature parts of the arc starting point and the terminal point part of an electrode will be reproduced. Moreover, in order to stabilize a halogen cycle, it is necessary to maintain bulb temperature at optimum temperature.

[0017] As above-mentioned, the halogen cycle which the electrode waste which time amount was taken and dispersed by the time the temperature of the arc starting point and the terminal point part of an electrode fully became an elevated temperature recombines with the arc starting point and the terminal point part of an electrode becomes inadequate [that the standup of the bulb temperature at the time of starting is late], and a halogen cycle unstable period becomes long. If a halogen cycle becomes unstable, the phenomenon of the melanism in which the worn-out electrode does not carry out self-healing, but the electrode waste which dispersed adheres to a lamp bulb occurs, and it is known that it will be easy to cause faults, such as an illuminance fall and formation of a short life. On the other hand, when the halogen cycle is stable, the worn-out electrode carries out self-healing, and does not result in fault.

[0018] About bulb temperature, optimum temperature can usually be attained comparatively easily by optimizing the fan for lamp cooling at the time of power mode. However, at the time of low power mode, even if electrode temperature is low and it makes late rotational speed of the fan for lamp cooling, since there are few electrons which fly about by the inter-electrode one in a bulb as compared with the time of power mode, and it usually optimizes, raising to optimum temperature is difficult so that clearly [in drawing 9]. That is, although halogen cycle instability does not usually say the low power mode saturation time B or subsequent ones compared with the time of power mode, since it was slightly inferior as stability, the danger of being always easy to generate fault was held.

[0019] Moreover, it is mentioned as another trouble that it is easy to generate a flicker. Drawing 7 shows how depending on which the electrode growth at the time of power mode and an arc usually fly. Since the bulb temperature standup at the time of starting reaches bulb optimum temperature immediately early, a halogen cycle unstable period is short and there is no wear of an electrode 1 so much. Only in a piece, after halogen cycle stability, the sharp projection 3 grows by the self-healing of the electrode waste slightly worn out into the starting point and the terminal point part of the arc at electrode 1 tip. As drawing 7 shows, the tip of this projection 3 is sharp, and is also the minimum distance and shifts to a stable condition in one more point compared with the arc stability in early stages of drawing 6 (b).

[0020] Drawing 8 shows how depending on which electrode wear of a period until how depending on which the arc at the time of starting at the time of low power mode flies, and electrode temperature are saturated, and the arc after electrode temperature saturation fly. Since the electron which flies about between a long top and an electrode 1 also has few periods until it reaches bulb saturation temperature, the temperature of the starting point and the terminal point part of the arc at the tip of an electrode does not fully go up in low power mode, either. Although an arc 2 is not stabilized in one point but the electrode 1 of the starting point and the terminal point part of this unstable arc 2 is worn out like drawing 8 (b) like a period until bulb temperature is saturated, and drawing 8 (a), since a halogen cycle is unstable, self-healing will not be carried out, but two or more irregular wear projections 4 will be able to be performed. Then, an arc 2 comes to fly at the tip of the wear projection 4 like drawing 8 (c). Since a halogen cycle is stabilized by after bulb temperature saturation, the electrode waste worn out at the tip of the wear projection 4 carries out self-healing, serves as the still sharper projection 3, and will be in the condition of being easy to carry out arcing between the tips of any projections 3 increasingly. this arc -- generally an unstable condition is called an arc jump. The fault of a flicker or a flicker comes to come out on a projection screen. Furthermore, since after bulb temperature saturation has not reached optimum temperature as above-mentioned, as compared with the time of power mode, as arc constancy, it will be inferior and an arc jump will usually be accelerated.

[0021] It was difficult to avoid the above-mentioned flicker generating at the time of low power mode according to these factors. The purpose of this invention solves the above-mentioned technical problem, and is to offer the image display device which prevents flicker generating at the time of low power mode.

[0022]

[Means for Solving the Problem] The display device to which this invention carries out intensity modulation of the light from the discharge lamp for the light sources, and said lamp in order to solve the above-mentioned technical problem, It has the optical system which carries out expansion projection of the light in which intensity modulation was carried out by this display device. In the image display device it was made to usually operate with either of the power modes and the low power modes in which supply said power usually lower than power mode, and said lamp is made to turn on which supply predetermined power to said discharge lamp It is characterized by supplying said predetermined rank power [in / usually / power mode] at said lamp until it carried out predetermined time progress from starting in starting from the condition that said low power mode is chosen.

[0023] Thus, since abbreviation rated power can be supplied to said lamp even if low power mode is chosen from starting to said predetermined time by constituting, the bulb temperature of said lamp can be started steeply and the stable projection shown in drawing 7 can be formed at the tip of the electrode of said lamp. in connection with this, the recombination to the electrode of the scattering electrode waste by the halogen cycle carries out -- having -- the formation of a short life of a lamp, and melanism -- it is effective in the ability to prevent the illuminance fall by reduction.

[0024]

[Embodiment of the Invention] Hereafter, the gestalt of operation of this invention is explained using drawing 1 , drawing 2 , and drawing 3 . The flow and drawing 3 which show power mode change processing according [the block diagram of the image display device whose drawing 2 is the gestalt of operation of this invention, and drawing 1] to this invention are drawing showing the relation of the lamp lighting power and lamp-bulb temperature by this invention.

[0025] First, the configuration of an image display device is explained using drawing 2 . In drawing 2 , while CPU7 performs the change in lamp lighting mode, the change of fan speed, etc., the whole image display device is controlled, and the processing program shown in ROM (not shown) to build in at drawing 1 is stored. A starting switch 5 is turned on, a timer 9 is controlled by CPU7 to start an elapsed time count from the time of CPU7 starting control, and the elapsed time counted with the timer 9 is transmitted to CPU7 with a predetermined time interval. In drawing 2 , the same sign is given to the part same to drawing 4 , and the explanation is omitted.

in addition, drawing 2 -- setting -- CPU7 -- a cooling fan-speed electronic switch 12 -- change ****** can control the mode of the lamp lighting power change mold stabilizer 11, and CPU7 can control the direct cooling-fan electrical-potential-difference change mold power source 13 and a lamp lighting power change mold stabilizer 11 by a change and the lamp lighting mode electronic switch 10 for the output supply voltage to the cooling fan 14 of the cooling-fan electrical-potential-difference change mold power source 13 -- if it becomes, a cooling fan-speed electronic switch 12 and a lamp lighting mode electronic switch 10 are unnecessary -- naturally things come out.

[0026] Next, drawing 3 is explained. Drawing 3 (a) shows the lighting power by which a seal of approval is carried out to a lamp, and drawing 3 (b) shows the bulb temperature of a lamp. Although the low power which is usually shown with the power mode lighting power curve 22 and which usually shows power with the low power mode lighting power curve 23 in low power mode again was usually conventionally supplied to the lamp in power mode so that clearly from drawing 3 (a) In this invention, at the time of low power mode, as the low power mode lighting power curve 24 shows, if the predetermined setup time C beforehand set up from starting usually supplies power and passes over the setup time C, it will supply low power. Thereby, like drawing 3 (b), at the time of low power mode, the bulb temperature of the lamp corresponding to the low power mode lighting power curve 24 becomes as the low power mode bulb temperature curve 25, reaches optimum temperature in laying temperature C, is lazy a temperature fall after that, and is reached and saturated with the low power mode saturation time B to the maximum temperature at the time of low power mode lighting. In addition, 20 is usually a power mode bulb temperature curve and the low power mode bulb temperature curve of the former [21] in drawing 3 (b).

[0027] This invention is explained in accordance with the flow which shows power mode change processing according the flicker prevention processing at the time of putting a lamp into operation in low power mode to this invention of drawing 1 , although it is the same as the processing flow of drawing 5 when usually putting a lamp into operation in power mode.

[0028] If a switch 5 is turned on and an image display device starts, seven will incorporate the selection condition in the lamp lighting mode stored in RAM8 at CPUS1, and the selection condition in lamp lighting mode will be checked.

[0029] When power mode is usually chosen in S1 here, rotation directions are more nearly usually than CPU7 taken out to the cooling fan speed electronic switch 12, a rotation signal is usually outputted to the cooling-fan electrical-potential-difference change mold power source 13 from the cooling fan speed electronic switch 12, the cooling-fan electrical-potential-difference change mold power source 13 usually supplies the supply voltage at the time of rotation to a cooling fan 14, and rotational speed of all the cooling fans 14 is usually considered as rotation (S2).

[0030] Moreover, when low power mode is chosen in S1, low-speed rotation directions are taken out with S3 to the cooling fan speed electronic switch 12 from CPU7, a low-speed rotation signal is outputted to the cooling-fan electrical-potential-difference change mold power source 13 from the cooling fan speed electronic switch 12, and the cooling-fan electrical-potential-difference change mold power source 13 supplies the supply voltage at the time of low-speed rotation to a cooling fan 14, and considers rotational speed of all the cooling fans 14 as low-speed rotation.

[0031] Next, power lighting directions are more nearly usually than CPU7 taken out with S4 to the lamp lighting mode electronic switch 10 irrespective of the selection condition in the lamp lighting mode of S1, a power mode signal is usually outputted to the lamp lighting power change mold stabilizer 11 from the lamp lighting mode electronic switch 10, the lamp lighting power change mold stabilizer 11 usually supplies power to a lamp 15, and a lamp 15 usually serves as power lighting. Thus, it considers as the period from starting to the setup time C, and usual power lighting irrespective of the selection condition in the lamp lighting mode of S1 like the low power mode lighting power curve 24 of this invention of drawing 3 (a). This point is the big difference from the conventional method. In addition, the setup time C becomes shorter than the low power mode saturation time B that what is necessary is just to choose by the time amount

to which the bulb temperature of a lamp 15 reaches optimum temperature.
[0032] Then, whether the elapsed time from starting exceeds the predetermined setup time C set up beforehand by S5, and when not checking and exceeding, return and the above-mentioned flow are repeated to S1. Moreover, when exceeding, it goes to S6.
[0033] Even if lamp lighting mode is low power mode, bulb temperature can be made to start from starting quickly in the period of the setup time C as by carrying out like this shows to the low power mode bulb temperature curve 25 of this invention of drawing 3 (b). Consequently, a halogen cycle accelerates and, only in a piece, projection 3 grows at the tip of each electrode 1 like drawing 7 .
[0034] The reason for making fan speed low-speed rotation is making bulb temperature start quickly, and, in addition to the purpose which accelerates a halogen cycle, considers a thing in case the purpose in low power mode is the low noise. However, it is necessary to check that it does not exceed the temperature rating of a use member that the refrigeration capacity of each part of this period is inadequate since it is not avoided.
[0035] It is the same as the conventional processing flow shown in drawing 5 after S6. Hereafter, by S6, CPU7 supervises the condition of the lamp lighting mode circuit changing switch 6, and the condition in lamp lighting mode is checked. the case where power mode is usually chosen in S6 here -- two or more fans 14 for cooling -- all rotational speed is usually considered as rotation (S7), and a lamp 15 is usually considered as power lighting (S8).
[0036] moreover, the case where low power mode is chosen in S6 -- two or more fans 14 for cooling -- all rotational speed is considered as low-speed rotation, and (S9) and a lamp 15 are considered as low power lighting (S10). At this time, bulb temperature begins to fall after the setup time C, and is reached and saturated with the low power mode saturation time B to the maximum temperature at the time of a low power drive as well as the former as it is shown in the low power mode bulb temperature curve 25 of this invention of drawing 3 (b). This saturated temperature is somewhat lower than optimum temperature, and it is as having already stated that it is in the condition which is slightly inferior as arc stability.
[0037] However, since the projection is growing at each tip of an electrode only in the piece as a result of accelerating a halogen cycle in the period from starting to the setup time C by this invention, arc stability comes out enough, a projection grows further in a halogen cycle in addition to a certain thing and an arc is stabilized very much, an arc jump cannot take place very easily and does not result in a flicker.
[0038] Then, supervising the modification actuation existence in lamp lighting mode is continued until it is stopped (S11). In S11, when lamp lighting mode has modification, return is repeated to S6, and the above-mentioned flows from S6 to S11 are repeated after that again. In S11, when there is no modification in lamp lighting power mode, the condition till then is held until it stops.
[0039] As are stated above, and the low power mode lighting power curve 24 of drawing 3 (a) shows, at the time of low power mode starting to the setup time C Since a halogen cycle unstable period can be shortened compared with the time of the conventional low power mode and the stable projection of a piece can be formed at the tip of an electrode by usually supplying power to a lamp even if low power mode is chosen the recombination to the electrode of the scattering electrode waste [can prevent a flicker resulting from an arc jump, and also] by the halogen cycle -- following -- the formation of a lamp short life, and melanism -- the illuminance fall by reduction etc. can be prevented.
[0040] In addition, while the setup time C predetermined from starting although usually considered as rotation or low-speed rotation with the lamp lighting mode with which the setup time C predetermined with the above-mentioned explanation from starting usually considered the lamp as power lighting, and the cooling fan 14 was set up, in order to simplify a processing flow usually considers a lamp as power lighting, it may be made to consider a cooling fan 14 as low-speed rotation. By doing in this way, a halogen cycle unstable period can usually be shortened compared with the former also in power mode.
[0041]
[Effect of the Invention] In case it starts in low power mode, it becomes possible to shorten a halogen cycle unstable period extremely by controlling lamp drive power and Cooling FAN by the

timer and the control means, and making the standup of the temperature in a lamp bulb steep, and a flicker can be prevented, and also the formation of a lamp short life, an illuminance fall, etc. can be prevented.

[Translation done.]

* NOTICES *

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2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

TECHNICAL FIELD

[Field of the Invention] Using the discharge lamp for back lights, this invention usually has power mode and two or more lamp lighting modes in low power mode for a lamp, and relates them to the image display device which can be chosen and changed freely.

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PRIOR ART

[Description of the Prior Art] Generally, the high-pressure discharge lamp for back lights used for a liquid crystal projector etc. becomes an elevated temperature considerably, and a liquid crystal panel, a polarizing plate, etc. are further exposed considerably to an elevated temperature according to the flux of light by which outgoing radiation was carried out from the lamp. For this reason, the lamp, the liquid crystal panel, the polarizing plate, etc. are usually cooled using two or more fans for cooling.
[0003] However, for example in the front projection mold liquid crystal projector etc., a fan's rotation sound is sensed as the noise with being used [much] near the user worried very much, and low noise-ization is called for. Moreover, low electrification is also called for from the point of power saving.
[0004] Therefore, recently, as the reduction in the noise, or a means for low-electrifying, even if it made some illuminances into the sacrifice, the high-pressure discharge lamp which is a heat source is made to turn on with low power, and the approach of carrying out change ****** began to be applied to the low power mode which also makes rotational speed of the fan for cooling late according to it. Below, for convenience, while carrying out drive lighting of the lamp with abbreviation rated power (this power is usually called power below), suppose that a fan also makes the mode driven with a predetermined rotational speed contrast with low power mode, and usually calls power mode.
[0005] In this low power mode, since the own calorific value of a lamp itself falls, and it follows in footsteps of it, the outgoing radiation light from a lamp dims and the temperature of a liquid crystal panel, a polarizing plate, etc. is also fallen by making a lamp drive with low power, while-izing of the rotational speed of two or more fans for cooling of all, that cool these, can usually be carried out [low speed] as compared with power mode and low noise-ization can be attained, low electrification can also be attained as an image display device.
[0006] Hereafter, the image display device equipped with conventional usual power mode and low power mode using drawing 4 and drawing 5 is explained. Drawing 4 is the outline block diagram of the image display device by the conventional technique, and drawing 5 is a flow which shows the conventional power mode change processing.
[0007] First, the configuration of an image display device is explained using drawing 4 . In drawing 4 , when a switch 5 turns this on, it is the switch stopped by making it start and turning off an image display device, this switch information is inputted into a microcomputer (Following CPU is called) 70, and, in ON actuation, CPU70 starts an image display device. The user of the lamp lighting mode circuit changing switch 6 is in lamp lighting mode, i.e., the above-mentioned switch which usually chooses and sets up power mode or low power mode, freely. Even if it is not especially a switch, what can be set up in the menu screen of OSD (onscreen display) etc. may be used. The selected lamp lighting mode is stored in RAM8 by CPU70, and unless a user changes a setup with the lamp lighting mode circuit changing switch 6, it is held.
[0008] While CPU70 performs the change in lamp lighting mode, the change of fan speed, etc., the whole image display device is controlled, and the processing program shown in ROM (read only memory) to build in, and which is not illustrated at drawing 5 is stored. The lamp lighting mode electronic switch 10 outputs the change signal, i.e., a usual power mode signal, which

changes the lighting power which the lamp lighting power change mold stabilizer 11 supplies to a lamp 15, and a low power mode signal to the lamp lighting power change mold stabilizer 11 in response to the directions from CPU70 corresponding to the lamp lighting mode set up with the lamp lighting mode circuit changing switch 6.

[0009] The lamp lighting power change mold stabilizer 11 usually carries out the lighting drive of the ****** lamp 15 for the power for [which is a high-pressure discharge lamp] turning on the lamp 15 of an extra-high pressure mercury lamp, for example with the change signal from the lamp lighting mode electronic switch 10 at power or low power. In addition, after carrying out the seal of approval of the high voltage, and this change making it discharge on a lamp 15 with the starting system (for it to also be called an ignitor) which the lamp lighting power change mold stabilizer 11 contains and which is not illustrated and forming a discharge way, it is performed.

[0010] The cooling fan speed electronic switch 12 outputs the usual rotation signal and low-speed rotation signal which are a change signal which controls the cooling-fan electrical-potential-difference change mold power source 13 in response to the directions from CPU70 corresponding to the lamp lighting mode set up with the lamp lighting mode circuit changing switch 6. The cooling-fan electrical-potential-difference change mold power source 13 changes the supply voltage supplied to a cooling fan to the predetermined usual rotation supply voltage or the low-speed rotation supply voltage set up beforehand with the change signal outputted from the cooling fan speed electronic switch 12. Two or more cooling fans 14 (141, 142, 143) which cool a lamp 15, optical system 16, and the lamp lighting power change mold stabilizer 11 are controlled by supply voltage from the cooling-fan electrical-potential-difference change mold power source 13 (131, 132, 133) by one of two or more rotational frequencies set up beforehand at reduced rpm.

[0011] For example, the flux of light from the lamp 15 of an extra-high pressure mercury lamp is projected by the screen 19 as an image light according to the optical system 16 which carries out light modulation to the shade for every pixel corresponding to the video signal which is not illustrated with the liquid crystal panel 18 which is the high-pressure discharge lamp to which power is supplied with the lamp lighting power change mold stabilizer 11, which is a display device, and which was equipped with the polarizing plate 17, for example and which is expanded with a projector lens (not shown).

[0012] Next, the flow of drawing 5 which shows power mode change processing is explained. In drawing 5 , first, a starting switch 5 is turned on and an image display device is started. If it starts, at step 12 (a step is abbreviated to S below), CPU70 will read the selection condition in lamp lighting mode from RAM8, and will check it. the case where power mode is usually chosen in S12 -- two or more fans 14 for cooling -- all rotational speed is usually considered as rotation (S13), and a lamp 15 is usually considered as power lighting (S14). moreover, the case where low power mode is chosen in S12 -- two or more fans 14 for cooling -- all rotational speed is considered as low-speed rotation (S15), and a lamp 15 is considered as low power lighting (S16).

[0013] Then, supervising the modification actuation existence in lamp lighting mode is continued until it is stopped (S17). In S17, when lamp lighting mode has modification, return and the above-mentioned processing are again performed similarly to S12. In S17, when there is no modification in lamp lighting mode, the condition till then is held until it is stopped.

[Translation done.]

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EFFECT OF THE INVENTION

[Effect of the Invention] In case it starts in low power mode, it becomes possible to shorten a halogen cycle unstable period extremely by controlling lamp drive power and Cooling FAN by the timer and the control means, and making the standup of the temperature in a lamp bulb steep, and a flicker can be prevented, and also the formation of a lamp short life, an illuminance fall, etc. can be prevented.

[Translation done.]

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TECHNICAL PROBLEM

[Problem(s) to be Solved by the Invention] With the above-mentioned conventional technique, when starting from low power mode, there were the two following problems. Since one drives a lamp with low power lower than rated (usually) power in low power mode, it is that the standup of the bulb (bulb) temperature of a lamp becomes late, and a halogen cycle unstable period becomes long. Drawing 9 shows the rising characteristic of the bulb temperature of the lamp in the conventional technique. Usually, at the time of power mode, after starting, it is usually the power mode saturation time A, and bulb temperature reaches a predetermined optimum temperature mostly as usually shown in the power mode bulb temperature curve 20. However, since the time amount to the low power mode saturation time B to which the bubble temperature of a lamp reaches saturation is long after starting and the standup is late, a halogen cycle unstable period becomes long as shown in the low power mode bulb temperature curve 21 at the time of low power mode. Drawing 6 shows the early arc formation in an alternating current lamp, and drawing 6 (a) shows the early arc in which drawing 6 (b) is formed by inter-electrode in the electrode of the lamp countered and formed.
[0015] In drawing 6 (a), it is easy to generate the arc generated between the counterelectrodes 1 in a bulb of a lamp in an elevated temperature and the sharp part between the minimum distances at the tip of an electrode 1 as everyone knows. Usually, an arc 2 occurs in the central neighborhood of the electrode 1 which is the minimum distance as shown in drawing 6 (b). Moreover, once an arc 2 occurs, since the emitted electron collides at high speed, temperature will become high, and its starting point and terminal point part will tend to be stabilized in one point.
[0016] However, an electrode is worn out by this collision. The emission electron which jumped out of the electrode generates electrode wear, when colliding to a counterelectrode. It is necessary to carry out dielectric breakdown and to make the light switch on, since the seal of approval of the high voltage is carried out, the emission electron accelerates considerably, especially in the case of starting, electrode wear is large, and its wear range is also wide. However, within the bulb, the self-healing of the worn-out electrode waste called halogen cycle occurs as everyone knows, and it is known that the elevated-temperature parts of the arc starting point and the terminal point part of an electrode will be reproduced. Moreover, in order to stabilize a halogen cycle, it is necessary to maintain bulb temperature at optimum temperature.
[0017] As above-mentioned, the halogen cycle which the electrode waste which time amount was taken and dispersed by the time the temperature of the arc starting point and the terminal point part of an electrode fully became an elevated temperature recombines with the arc starting point and the terminal point part of an electrode becomes inadequate [that the standup of the bulb temperature at the time of starting is late], and a halogen cycle unstable period becomes long. If a halogen cycle becomes unstable, the phenomenon of the melanism in which the worn-out electrode does not carry out self-healing, but the electrode waste which dispersed adheres to a lamp bulb occurs, and it is known that it will be easy to cause faults, such as an illuminance fall and formation of a short life. On the other hand, when the halogen cycle is stable, the worn-out electrode carries out self-healing, and does not result in fault.

[0018] About bulb temperature, optimum temperature can usually be attained comparatively easily by optimizing the fan for lamp cooling at the time of power mode. However, at the time of low power mode, even if electrode temperature is low and it makes late rotational speed of the fan for lamp cooling, since there are few electrons which fly about by the inter-electrode one in a bulb as compared with the time of power mode, and it usually optimizes, raising to optimum temperature is difficult so that clearly [in drawing 9]. That is, although halogen cycle instability does not usually say the low power mode saturation time B or subsequent ones compared with the time of power mode, since it was slightly inferior as stability, the danger of being always easy to generate fault was held.
[0019] Moreover, it is mentioned as another trouble that it is easy to generate a flicker. Drawing 7 shows how depending on which the electrode growth at the time of power mode and an arc usually fly. Since the bulb temperature standup at the time of starting reaches bulb optimum temperature immediately early, a halogen cycle unstable period is short and there is no wear of an electrode 1 so much. Only in a piece, after halogen cycle stability, the sharp projection 3 grows by the self-healing of the electrode waste slightly worn out into the starting point and the terminal point part of the arc at electrode 1 tip. As drawing 7 shows, the tip of this projection 3 is sharp, and is also the minimum distance and shifts to a stable condition in one more point compared with the arc stability in early stages of drawing 6 (b).
[0020] Drawing 8 shows how depending on which electrode wear of a period until how depending on which the arc at the time of starting at the time of low power mode flies, and electrode temperature are saturated, and the arc after electrode temperature saturation fly. Since the electron which flies about between a long top and an electrode 1 also has few periods until it reaches bulb saturation temperature, the temperature of the starting point and the terminal point part of the arc at the tip of an electrode does not fully go up in low power mode, either. Although an arc 2 is not stabilized in one point but the electrode 1 of the starting point and the terminal point part of this unstable arc 2 is worn out like drawing 8 (b) like a period until bulb temperature is saturated, and drawing 8 (a), since a halogen cycle is unstable, self-healing will not be carried out, but two or more irregular wear projections 4 will be able to be performed. Then, an arc 2 comes to fly at the tip of the wear projection 4 like drawing 8 (c). Since a halogen cycle is stabilized by after bulb temperature saturation, the electrode waste worn out at the tip of the wear projection 4 carries out self-healing, serves as the still sharper projection 3, and will be in the condition of being easy to carry out arcing between the tips of any projections 3 increasingly. this arc — generally an unstable condition is called an arc jump. The fault of a flicker or a flicker comes to come out on a projection screen. Furthermore, since after bulb temperature saturation has not reached optimum temperature as above-mentioned, as compared with the time of power mode, as arc constancy, it will be inferior and an arc jump will usually be accelerated.
[0021] It was difficult to avoid the above-mentioned flicker generating at the time of low power mode according to these factors. The purpose of this invention solves the above-mentioned technical problem, and is to offer the image display device which prevents flicker generating at the time of low power mode.

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MEANS

[Means for Solving the Problem] The display device to which this invention carries out intensity modulation of the light from the discharge lamp for the light sources, and said lamp in order to solve the above-mentioned technical problem, It has the optical system which carries out expansion projection of the light in which intensity modulation was carried out by this display device: In the image display device it was made to usually operate with either of the power modes and the low power modes in which supply said power usually lower than power mode, and said lamp is made to turn on which supply predetermined power to said discharge lamp It is characterized by supplying said predetermined rank power [in / usually / power mode] at said lamp until it carried out predetermined time progress from starting in starting from the condition that said low power mode is chosen.
[0023] Thus, since abbreviation rated power can be supplied to said lamp even if low power mode is chosen from starting to said predetermined time by constituting, the bulb temperature of said lamp can be started steeply and the stable projection shown in drawing 7 can be formed at the tip of the electrode of said lamp. in connection with this, the recombination to the electrode of the scattering electrode waste by the halogen cycle carries out -- having -- the formation of a short life of a lamp, and melanism -- it is effective in the ability to prevent the illuminance fall by reduction.
[0024]
[Embodiment of the Invention] Hereafter, the gestalt of operation of this invention is explained using drawing 1 , drawing 2 , and drawing 3 . The flow and drawing 3 which show power mode change processing according [the block diagram of the image display device whose drawing 2 is the gestalt of operation of this invention, and drawing 1] to this invention are drawing showing the relation of the lamp lighting power and lamp-bulb temperature by this invention.
[0025] First, the configuration of an image display device is explained using drawing 2 . In drawing 2 , while CPU7 performs the change in lamp lighting mode, the change of fan speed, etc., the whole image display device is controlled, and the processing program shown in ROM (not shown) to build in at drawing 1 is stored. A starting switch 5 is turned on, a timer 9 is controlled by CPU7 to start an elapsed time count from the time of CPU7 starting control, and the elapsed time counted with the timer 9 is transmitted to CPU7 with a predetermined time interval. In drawing 2 , the same sign is given to the part same to drawing 4 , and the explanation is omitted. in addition, drawing 2 -- setting -- CPU7 -- a cooling fan-speed electronic switch 12 -- change ****** can control the mode of the lamp lighting power change mold stabilizer 11, and CPU7 can control the direct cooling-fan electrical-potential-difference change mold power source 13 and a lamp lighting power change mold stabilizer 11 by a change and the lamp lighting mode electronic switch 10 for the output supply voltage to the cooling fan 14 of the cooling-fan electrical-potential-difference change mold power source 13 -- if it becomes, a cooling fan-speed electronic switch 12 and a lamp lighting mode electronic switch 10 are unnecessary -- naturally things come out.
[0026] Next, drawing 3 is explained. Drawing 3 (a) shows the lighting power by which a seal of approval is carried out to a lamp, and drawing 3 (b) shows the bulb temperature of a lamp. Although the low power which is usually shown with the power mode lighting power curve 22 and

which usually shows power with the low power mode lighting power curve 23 in low power mode again was usually conventionally supplied to the lamp in power mode so that clearly from drawing 3 (a) In this invention, at the time of low power mode, as the low power mode lighting power curve 24 shows, if the predetermined setup time C beforehand set up from starting usually supplies power and passes over the setup time C, it will supply low power. Thereby, like drawing 3 (b), at the time of low power mode, the bulb temperature of the lamp corresponding to the low power mode lighting power curve 24 becomes as the low power mode bulb temperature curve 25, reaches optimum temperature in laying temperature C, is lazy a temperature fall after that, and is reached and saturated with the low power mode saturation time B to the maximum temperature at the time of low power mode lighting. In addition, 20 is usually a power mode bulb temperature curve and the low power mode bulb temperature curve of the former [21] in drawing 3 (b).

[0027] This invention is explained in accordance with the flow which shows power mode change processing according the flicker prevention processing at the time of putting a lamp into operation in low power mode to this invention of drawing 1 , although it is the same as the processing flow of drawing 5 when usually putting a lamp into operation in power mode.

[0028] If a switch 5 is turned on and an image display device starts, seven will incorporate the selection condition in the lamp lighting mode stored in RAM8 at CPUS1, and the selection condition in lamp lighting mode will be checked.

[0029] When power mode is usually chosen in S1 here, rotation directions are more nearly usually than CPU7 taken out to the cooling fan speed electronic switch 12, a rotation signal is usually outputted to the cooling-fan electrical-potential-difference change mold power source 13 from the cooling fan speed electronic switch 12, the cooling-fan electrical-potential-difference change mold power source 13 usually supplies the supply voltage at the time of rotation to a cooling fan 14, and rotational speed of all the cooling fans 14 is usually considered as rotation (S2).

[0030] Moreover, when low power mode is chosen in S1, low-speed rotation directions are taken out with S3 to the cooling fan speed electronic switch 12 from CPU7, a low-speed rotation signal is outputted to the cooling-fan electrical-potential-difference change mold power source 13 from the cooling fan speed electronic switch 12, and the cooling-fan electrical-potential-difference change mold power source 13 supplies the supply voltage at the time of low-speed rotation to a cooling fan 14, and considers rotational speed of all the cooling fans 14 as low-speed rotation.

[0031] Next, power lighting directions are more nearly usually than CPU7 taken out with S4 to the lamp lighting mode electronic switch 10 irrespective of the selection condition in the lamp lighting mode of S1, a power mode signal is usually outputted to the lamp lighting power change mold stabilizer 11 from the lamp lighting mode electronic switch 10, the lamp lighting power change mold stabilizer 11 usually supplies power to a lamp 15, and a lamp 15 usually serves as power lighting. Thus, it considers as the period from starting to the setup time C, and usual power lighting irrespective of the selection condition in the lamp lighting mode of S1 like the low power mode lighting power curve 24 of this invention of drawing 3 (a). This point is the big difference from the conventional method. In addition, the setup time C becomes shorter than the low power mode saturation time B that what is necessary is just to choose by the time amount to which the bulb temperature of a lamp 15 reaches optimum temperature.

[0032] Then, whether the elapsed time from starting exceeds the predetermined setup time C set up beforehand by S5, and when not checking and exceeding, return and the above-mentioned flow are repeated to S1. Moreover, when exceeding, it goes to S6.

[0033] Even if lamp lighting mode is low power mode, bulb temperature can be made to start from starting quickly in the period of the setup time C as by carrying out like this shows to the low power mode bulb temperature curve 25 of this invention of drawing 3 (b). Consequently, a halogen cycle accelerates and, only in a piece, projection 3 grows at the tip of each electrode 1 like drawing 7 .

[0034] The reason for making fan speed low-speed rotation is making bulb temperature start quickly, and, in addition to the purpose which accelerates a halogen cycle, considers a thing in

case the purpose in low power mode is the low noise. However, it is necessary to check that it does not exceed the temperature rating of a use member that the refrigeration capacity of each part of this period is inadequate since it is not avoided.

[0035] It is the same as the conventional processing flow shown in drawing 5 after S6. Hereafter, by S6, CPU7 supervises the condition of the lamp lighting mode circuit changing switch 6, and the condition in lamp lighting mode is checked. the case where power mode is usually chosen in S6 here -- two or more fans 14 for cooling -- all rotational speed is usually considered as rotation (S7), and a lamp 15 is usually considered as power lighting (S8).

[0036] moreover, the case where low power mode is chosen in S6 -- two or more fans 14 for cooling -- all rotational speed is considered as low-speed rotation, and (S9) and a lamp 15 are considered as low power lighting (S10). At this time, bulb temperature begins to fall after the setup time C, and is reached and saturated with the low power mode saturation time B to the maximum temperature at the time of a low power drive as well as the former as it is shown in the low power mode bulb temperature curve 25 of this invention of drawing 3 (b). This saturated temperature is somewhat lower than optimum temperature, and it is as having already stated that it is in the condition which is slightly inferior as arc stability.

[0037] However, since the projection is growing at each tip of an electrode only in the piece as a result of accelerating a halogen cycle in the period from starting to the setup time C by this invention, arc stability comes out enough, a projection grows further in a halogen cycle in addition to a certain thing and an arc is stabilized very much, an arc jump cannot take place very easily and does not result in a flicker.

[0038] Then, supervising the modification actuation existence in lamp lighting mode is continued until it is stopped (S11). In S11, when lamp lighting mode has modification, return is repeated to S6, and the above-mentioned flows from S6 to S11 are repeated after that again. In S11, when there is no modification in lamp lighting power mode, the condition till then is held until it stops.

[0039] As are stated above, and the low power mode lighting power curve 24 of drawing 3 (a) shows, at the time of low power mode starting to the setup time C Since a halogen cycle unstable period can be shortened compared with the time of the conventional low power mode and the stable projection of a piece can be formed at the tip of an electrode by usually supplying power to a lamp even if low power mode is chosen the recombination to the electrode of the scattering electrode waste [can prevent a flicker resulting from an arc jump, and also] by the halogen cycle -- following -- the formation of a lamp short life, and melanism -- the illuminance fall by reduction etc. can be prevented.

[0040] In addition, while the setup time C predetermined from starting although usually considered as rotation or low-speed rotation with the lamp lighting mode with which the setup time C predetermined with the above-mentioned explanation from starting usually considered the lamp as power lighting, and the cooling fan 14 was set up, in order to simplify a processing flow usually considers a lamp as power lighting, it may be made to consider a cooling fan 14 as low-speed rotation. By doing in this way, a halogen cycle unstable period can usually be shortened compared with the former also in power mode.

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DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] The flow which shows the power mode change processing by this invention.
[Drawing 2] The block diagram of the image display device which is the gestalt of operation of this invention.
[Drawing 3] Drawing showing the relation of the lamp lighting power and lamp-bulb temperature by this invention.
[Drawing 4] The outline block diagram of the image display device by the conventional technique.

[Drawing 5] The flow which shows the conventional power mode change processing.
[Drawing 6] Drawing showing the early arc formation in an alternating current lamp.
[Drawing 7] Usually, drawing showing how depending on which the electrode growth at the time of power mode and an arc fly.
[Drawing 8] Drawing showing how depending on which electrode wear of a period until how depending on which the arc at the time of starting at the time of low power mode flies, and electrode temperature are saturated, and the arc after electrode temperature saturation fly.
[Drawing 9] The rising characteristic of the bulb temperature of the lamp in the conventional technique.
[Description of Notations]
1 ... Electrode
2 ... Arc
3 ... Projection which carried out self-healing in the halogen cycle
4 ... Wear electrode
5 ... Switch
6 ... Lamp lighting mode circuit changing switch
7 70 ... CPU
8 ... RAM
9 ... Timer
10 ... Lamp lighting mode electronic switch
11 ... Lamp lighting power change mold stationary phase
12 ... Cooling fan speed electronic switch
13 ... Cooling-fan electrical-potential-difference change mold power source
14 ... Cooling fan
15 ... Lamp
16 ... Optical system
17 ... Polarizing plate
18 ... Liquid crystal panel
19 ... Screen
20 ... It is usually a power mode bulb temperature curve.
21 ... The conventional low power mode bulb temperature curve
22 ... It is usually a power mode lighting power curve.
23 ... The conventional low power mode lighting power curve

24 ... Low power mode lighting power curve of this invention
25 ... Low power mode bulb temperature curve of this invention

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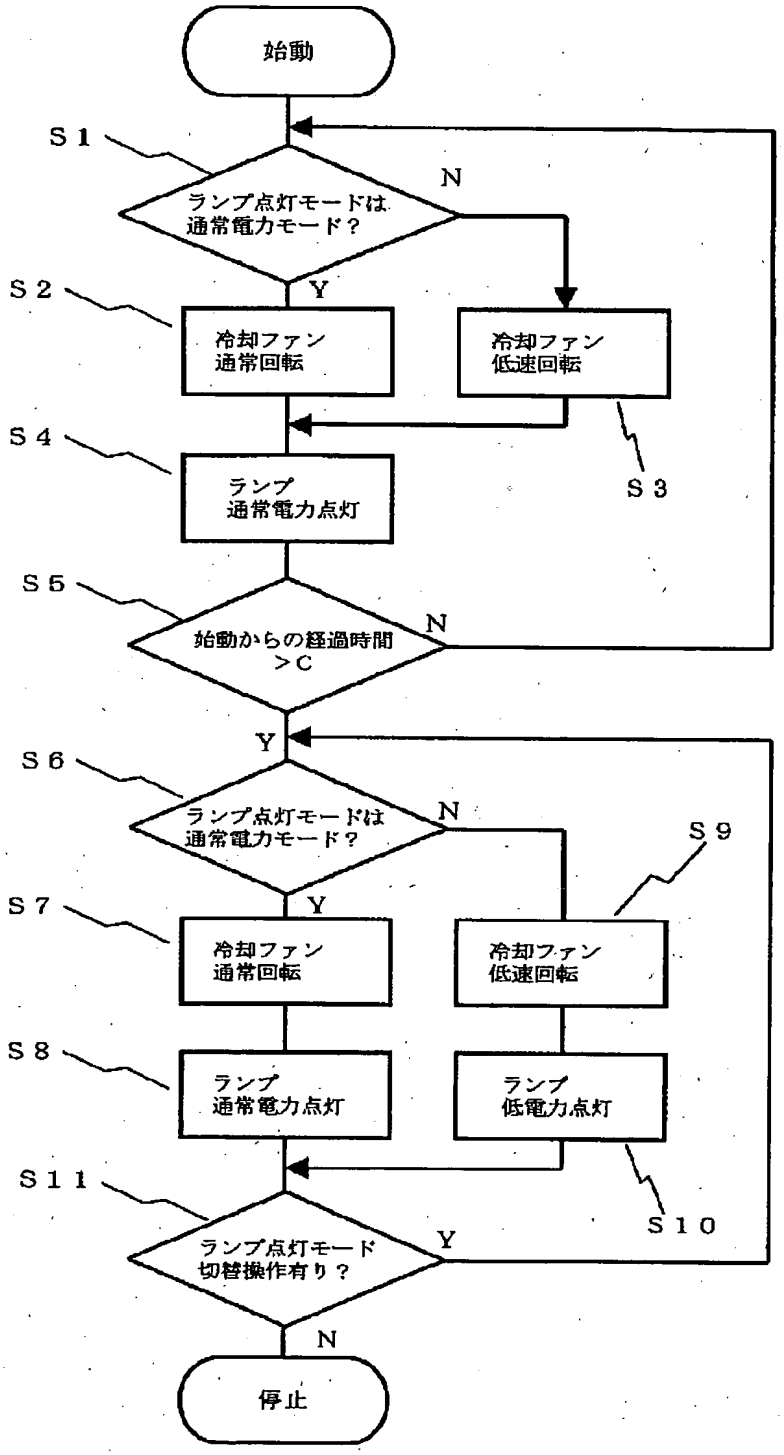
DRAWINGS

[Drawing 1]

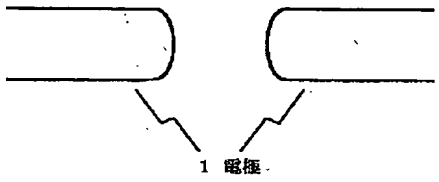
図 1


始動
S 1
ランプ点灯モードは
通常電力モード？
N
Y
S 2
冷却ファン
通常回転
冷却ファン
低速回転
S 3
S 4
ランプ
通常電力点灯
S 5
始動からの経過時間
＞C
N
Y
S 6
ランプ点灯モードは
通常電力モード？
N
S 9
Y
S 7
冷却ファン
通常回転
冷却ファン
低速回転
S 8
ランプ
通常電力点灯
ランプ
低電力点灯
S 10
S 11
ランプ点灯モード
切替操作有り？
Y
N
停止

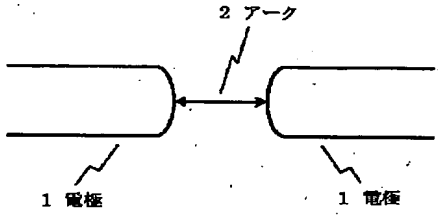
[Drawing 6]

図６

（ａ）

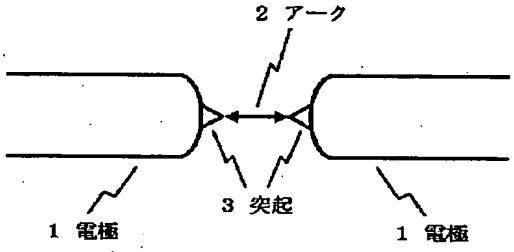


（ｂ）



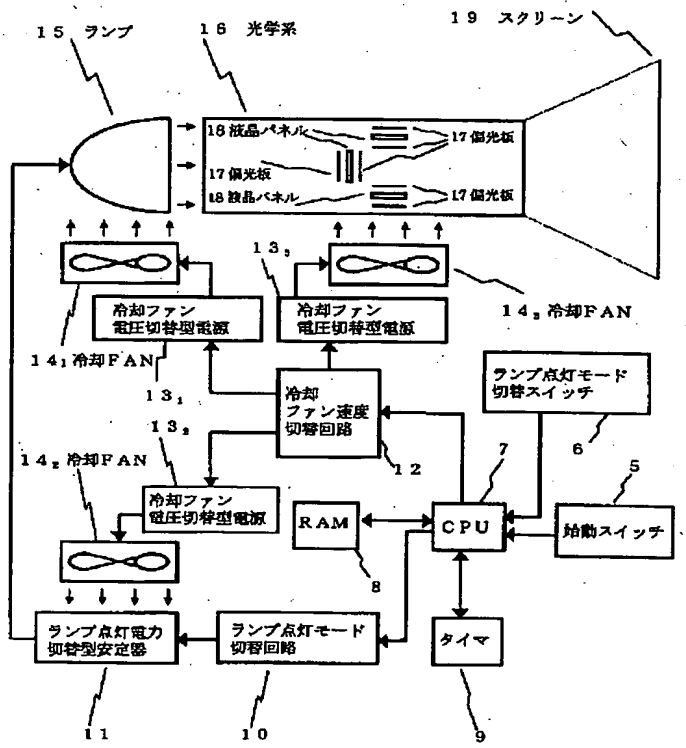
[Drawing 7]

図７



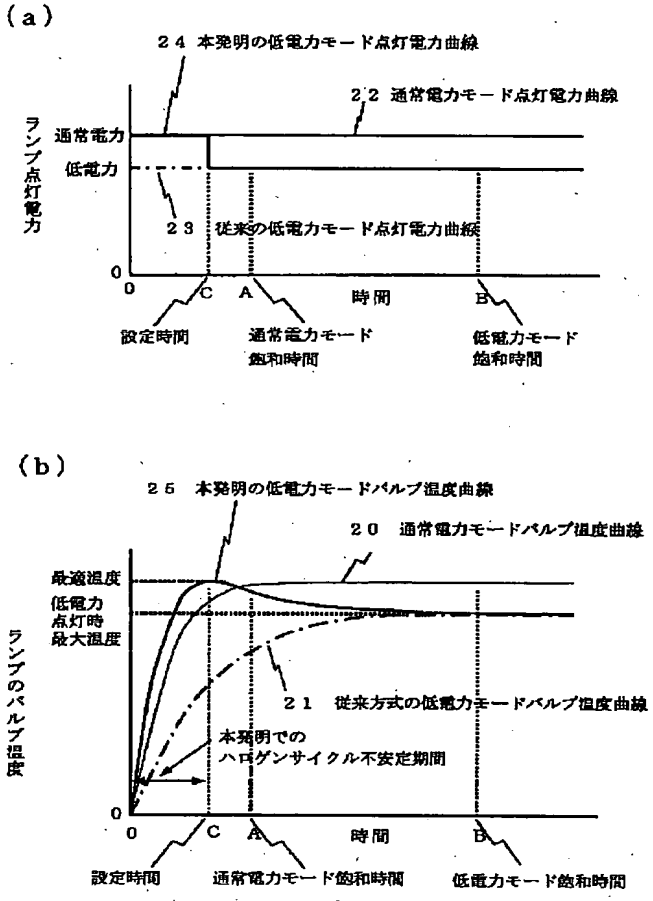
[Drawing 2]

図２



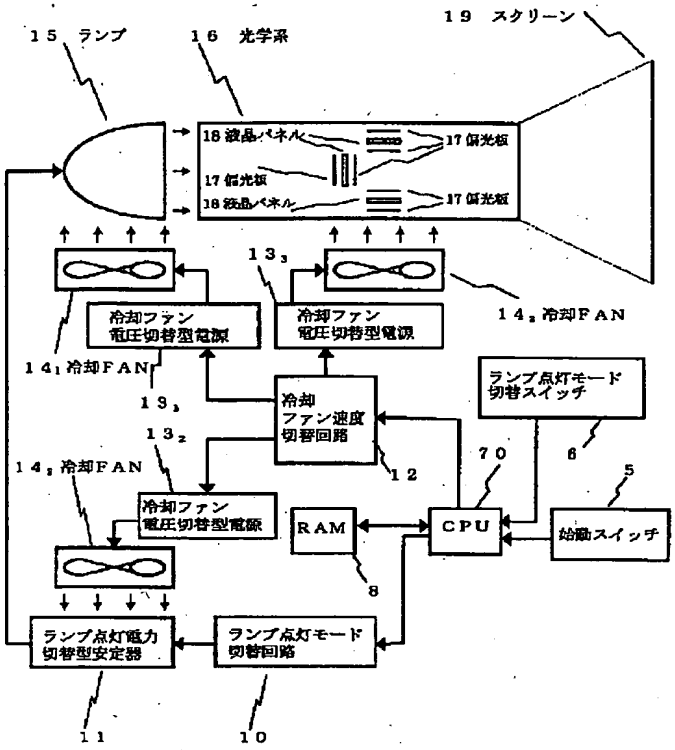
[Drawing 3]

図３



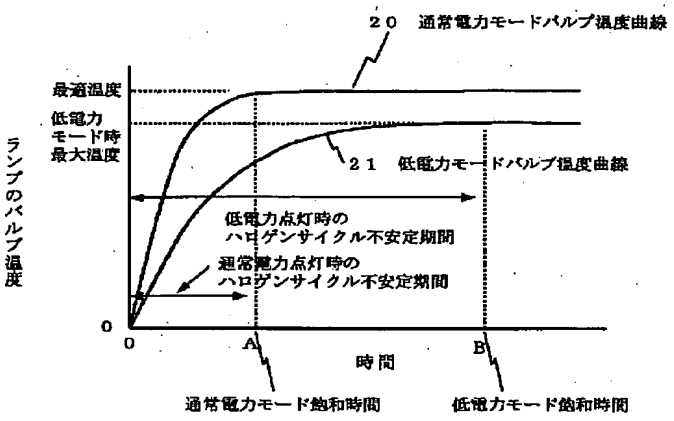
[Drawing 4]

図４



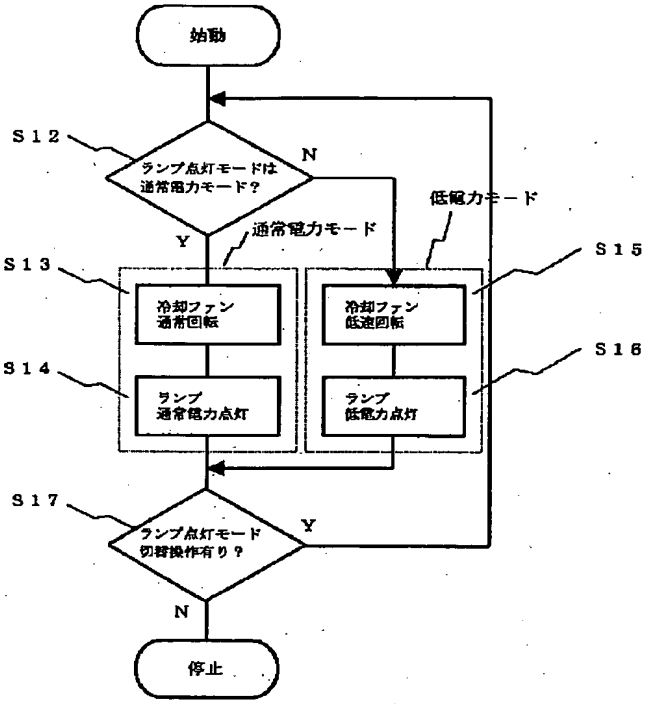
[Drawing 9]

図９



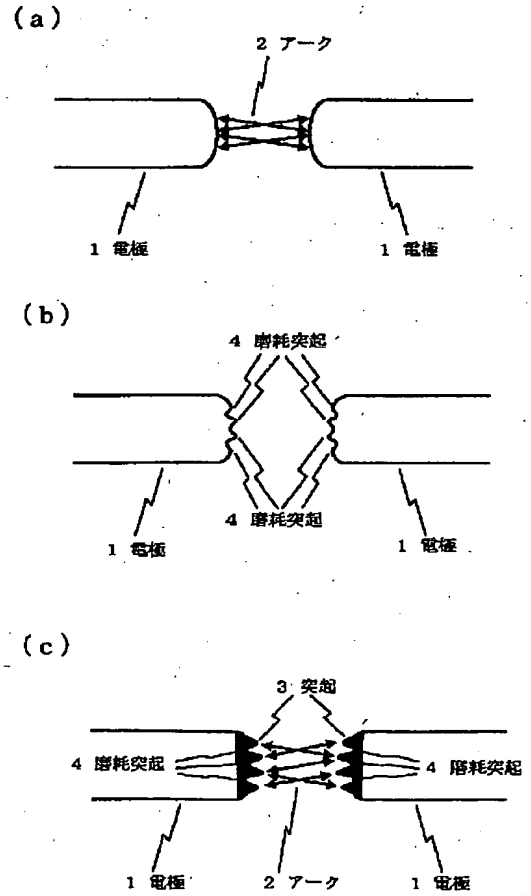
[Drawing 5]

図５



[Drawing 8]

図８



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